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10/523,397	04/08/2005	Francois Beguin	1721-84 ~	3733

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ARLINGTON, VA 22203

EXAMINER

ZIMMER, ANTHONY J

ART UNIT	PAPER NUMBER
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1709

MAIL DATE	DELIVERY MODE
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10/03/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/523,397

Applicant(s)

BEGUIN ET AL.

Examiner

Anthony J. Zimmer

Art Unit

1709

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 and 10-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8 and 10-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 February 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>02/03/2005</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Status

1. Claims 1-8 and 10-14 are pending and are subject to examination.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on 26 July 2005 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 1-8 and 10-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
6. The term "concentrated" in claims 1 and 3 is a relative term which renders the claim indefinite. The term "concentrated" is not defined by the claim, the specification

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does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. All dependent claims, encapsulating claims 2, 4-8, and 10-14 are rendered indefinite by the use of the term "concentrated" in claims 1 and 3. In the following office action the word concentrated will be interpreted as above 1 M.

7. The term "low" in claim 6 is a relative term which renders the claim indefinite. The term "low" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. In the following office action "low temperature" will be interpreted as being below the carbon dioxide gas treatment prior art process temperature cited in the specification of 850°C.

8. Claim 14 refers to "the method of claim 10", however claim 10 is drawn to opened carbon nanotubes. It is unclear to what claim 14 is referring, the method of producing the opened carbon nanotubes or the opened carbon nanotubes themselves. Therefore claim 14 is rendered indefinite. In this office action, claim 14 will be interpreted as referring to the opened carbon nanotubes of claim 10.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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10. Claims 1, 3, 6, and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Smith et al. (hereafter known as D1); see citation in PTO-892.

In regard to claim 1, 3, and 6 D1 discloses treating carbon nanotubes (that have been previously treated with 2.5 M nitric acid for 12 hours; see D1 page 3 left-hand column) with a carbon dioxide (gaseous) flow at a low temperature of 600°C (see D1, page 4, right-hand column, last paragraph).

In regard to claim 10, since the process disclosed in D1 is substantially identical the process as claimed in claim 1, the product produced in the process of D1 would necessarily be substantially identical to the product as claimed in claim 10, see MPEP 2112.01. Also, a person of ordinary skill in the art would recognize that nanotubes can be opened by using a liquid phase acid oxidation step, an inherent feature such as the opening of the mouths of the nanotubes with acid need not be recognized at the time of the invention, see MPEP 2112. There is evidence of the carbon nanotubes being opened in D1, i.e. there is a comparison between acid-pretreated nanotubes that have undergone different treatments. When explaining the possible reason for the difference in the adsorption curves, D1 explains that the mouths of the nanotubes are not blocked, and therefore inherently states that the nanotubes are open, see D1 page 3 right-hand column.

Therefore, claims 1, 3, and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by D1.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

13. Claims 2, 4-5, 7, and 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over D1 (see citation in 102 rejection above).

In regard to claim 2, D1 does not mention using multi-wall carbon nanotubes (MWNTs). However, it would have been obvious to one of ordinary skill in the art to apply the process of D1 to MWNTs. One of ordinary skill in the art would have been motivated to use MWNTs as they are commonly available,

easier to produce in large quantities than single-wall carbon nanotubes, and are cheaper than single walled nanotubes.

In regard to claims 4 and 12 D1 fails to teach using the particular ranges of concentration of carbon nanotubes in acid and the particular ranges of concentration of nitric acid used in the liquid stage.

In regard to claims 7 and 13 D1 fails to teach the particular temperature ranges (though it does teach 600°C like in claim 7) and the particular time range of treatment in the gas stage. In regard to claim 11, D1 fails to teach combining acid with the nanotubes in an excess amount.

It is the examiner's position the ranges of the concentration of carbon nanotubes in acid in the liquid stage; concentration of nitric acid in the liquid stage; temperature of the gas stage; duration of the gas stage; and using an excess amount of acid in the liquid stage would all have been obvious matters of design choice well within the level of ordinary skill in the art. Moreover, there is nothing in the record which establishes that the claimed parameters present novel or unexpected results (See *In re Kuhle*, 562 F. 2d 553, 188 USPQ 7 (CCPA 1975)). The general conditions of the claims are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980).

The particular range of concentration of carbon nanotubes in acid cited in claim 4 and claim 12 (1 gram in 0.5 – 2 liters in claim 4, and 1 gram in 1 liter in

claim 12) is simply a matter of design choice/routine optimization and using the particular amount does not produce an unexpected result. Thus the limitation of using the particular amount of carbon nanotubes as claimed is obvious over D1 and thus does not impart a patentable distinction.

Though the instant claims claim the use of a more concentrated acid than D1, the increased concentration simply produces the predictable result of shortening the reflux oxidation time over D1 (for instance a concentration of 15% by weight reacting for 12 hours in D1; and 68-70% reacting for 30-50 minutes in the instant claims). In sum, the difference between the result of the instant claims and the result of D1 is only that of the degree of time to which the reflux oxidation step is run, and produces no unexpected result.

The particular temperature ranges cited for use in the gas stage (500°C - 600°C in claim 7 and 500°C - 550°C) are similar to that used in D1 (600°C), are obvious variations of the process of D1. Temperature is recognized as being a critical variable in D1 (as a specific reaction temperature of 600°C is given). The temperature range claimed is a matter of design choice and optimization well within the level of ordinary skill. The claimed temperatures fail to produce an unexpected result and thus do not impart a patentable distinction.

The particular times of reaction for the gas stage (1-2 hours in claim 7 and 1-1 hour 40 minutes in claim 13) are simply matters of design choice and are obvious variants of the process of D1. Time is well known in the art to be a critical variable in the extent of a chemical reaction. Optimization of the time

required for a reaction is well within the level of ordinary skill, fails to produce and unexpected result, and thus does not impart a patentable distinction.

Using an excess amount of acid in the liquid stage simply produces the predictable result of causing the reaction to go to completion faster, as explained in the argument about the concentration of acid above.

Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art. In re Dreyfus, 22 CCPA (Patents) 830, 73 F.2d 931, 24 USPQ 52; In re Waite et al., 35 CCPA (Patents) 1117, 168 F.2d 104, 77 USPQ 586. Such ranges are termed "critical" ranges, and the applicant has the burden of proving such criticality. In re Swenson et al., 30 CCPA (patents) 809, 132 F.2d 1020, 56 USPQ 372; In re Scherl, 33 CCPA (patents) 1193, 156 F.2d 72, 70 USPQ 204. However, even though applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within the capabilities of one skilled in the art. In re Sola, 22 CCPA (patents) 1313, 77 F.2d 627, 25 USPQ 433; In re Normann et al., 32 CCPA (patents) 1248, 150 F.2d 627, 66 USPQ 308; In re Irmischer, 32 CCPA (Patents) 1259, 150 F.2d 705, 66 USPQ 314. More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. In re Swain et al., 33 CCPA (Patents) 1250, 156 F.2d 239, 70 USPQ 412; Minnesota Mining

and Mfg. Co. v. Coe, 69 App. D.C. 217, 99 F.2d 986, 38 USPQ 213; Allen et al. v. Coe, 77 App. D.C. 324, 135 F.2d 11, 57 USPQ 136.

In regard to claim 5, D1 teaches heating under reflux (see D1 page 3 left-hand column); and stirring is routine practice in the art.

Therefore, claims 2, 4-5, 7, and 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over D1.

14. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over D1, as applied to claim 1 above, in view of Dillon et al. (hereafter D2), see IDS for citation.

In regard to claim 8, D1 does not disclose an intermediate step of filtering and washing the nanotubes.

However, it would have been obvious to one of ordinary skill in the art to modify D1 in view of D2 as D2 discloses such an intermediate step (see page 1354, right-hand column, last paragraph). Also, steps of this kind are routine in the art. One of ordinary skill in the art would have been motivated to modify D1 in view of D2 in order to produce the predictable result of producing a purer product, i.e. one that contains fewer impurities.

Therefore, claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over D1 in view D2.

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15. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over D1, as applied to claim 1 and 10 above, in view of Kiang (hereafter D3); see IDS for citation.

In regard to claim 14, D1 fails to teach filling the nanotubes' central channel with a conductive species. However it would have been obvious to one of ordinary skill in the art at the time of the invention to modify D1 in view of D3, as D3 discloses filling carbon nanotubes with bismuth (a conductive species); see abstract of D3.

One of ordinary skill in the art would have been motivated to modify D1 in view of D3 in order to produce the predictable result of making nanowires which are useful in nanoelectronics.

Therefore, claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over D1 in view of D3.

Conclusion

16. In sum, all claims are rejected and no claim is allowed.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anthony J. Zimmer whose telephone number is 571-

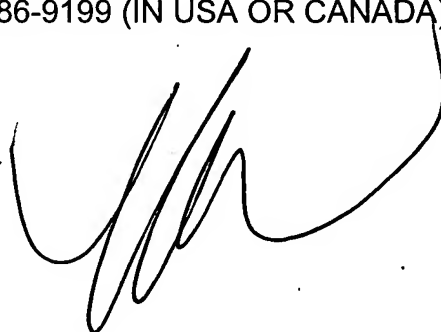
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270-3591. The examiner can normally be reached on Monday - Friday 7:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on 571-272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ajz

A handwritten signature in black ink, appearing to be 'Vickie Y. Kim', written over a horizontal line.

VICKIE Y. KIM
SUPERVISORY PATENT EXAMINER